CLAIMS

1. A method for producing fullerene crystals comprising:

i) bringing a solution and a second solvent into contact with each other so that a liquid-liquid interface is formed therebetween, the solution including a first solvent containing a benzene derivative (A) whose content is at least 50 wt.% and fullerene dissolved in the first solvent, and the second solvent having a lower solubility of the fullerene than that of the first solvent; and

ii) allowing the solution and the second solvent to be mixed together through counter diffusion of the solution and the second solvent to deposit crystals of the fullerene,

wherein the benzene derivative (A) is at least one benzene derivative selected from the group consisting of a benzene derivative in which at least two hydrogen atoms of a benzene ring have been substituted, halogenated benzene, and alkoxybenzene.

2. The method for producing fullerene crystals according to claim 1, wherein in the process (ii), the solution and the second solvent are mixed together by allowing the solution stand still for a predetermined period of time.

3. The method for producing fullerene crystals according to claim 1, wherein the benzene derivative (A) is one type of benzene derivative with no structural isomerism or one selected from a plurality of structural isomers of one type of benzene derivative with structural isomerism.

4. The method for producing fullerene crystals according to claim 1, wherein the solubility of the fullerene in the second solvent is 0.01 mg/ml or lower at 25°C.

5. The method for producing fullerene crystals according to claim 1, wherein the benzene derivative (A) is at least one benzene derivative selected from the group consisting of a benzene derivative with a benzene ring that has been substituted at the meta position, a benzene derivative with a benzene ring that has been substituted at 1,3,5-positions, halogenated benzene, and alkoxybenzene.

6. The method for producing fullerene crystals according to claim 5, wherein the benzene derivative (A) is at least one benzene derivative selected from the group consisting of m-dialkylbenzene, m-dihalogenated benzene, halogenated benzene, 1,3,5-trialkylbenzene, 1,3,5-trihalogenated benzene, 3-halogenated toluene, and alkoxybenzene.

7. The method for producing fullerene crystals according to claim 5, wherein the benzene derivative (A) is at least one selected from the group consisting of m-xylene, 1,3,5-trimethylbenzene, chlorobenzene, m-dichlorobenzene, 3-chlorotoluene, and methoxybenzene.

8. The method for producing fullerene crystals according to claim 5, wherein the second solvent contains, in total, at least 50 wt.% of at least one alcohol selected from the group consisting of n-propyl alcohol, i-propyl alcohol, n-butyl alcohol, i-butyl alcohol, 2-butyl alcohol, n-pentyl alcohol, and i-pentyl alcohol.

9. The method for producing fullerene crystals according to claim 5, wherein the concentration of the fullerene contained in the solution is at least 0.3 mg/ml as well as at least 0.15X (mg/ml), where X (mg/ml) denotes the solubility of the fullerene in the first solvent.

10. The method for producing fullerene crystals according to claim 5, further comprising forming a nonwoven fabric using the fullerene crystals.

11. The method for producing fullerene crystals according to claim 1, wherein the benzene derivative (A) is at least one selected from a benzene derivative with a benzene ring that has been substituted at the ortho-position, and a benzene derivative with a benzene ring that has been substituted at 1,2,4-positions,

and in the process (i), a solid wall is placed to form a solid-liquid interface with the solution.

12. The method for producing fullerene crystals according to claim 11, wherein the benzene derivative (A) is at least one selected from the group consisting of o-xylene, 1,2,4-trimethylbenzene, o-dichlorobenzene, and

2-chlorotoluene.

13. The method for producing fullerene crystals according to claim 11, wherein the second solvent contains at least 50 wt.% of at least one alcohol selected from the group consisting of alcohol with a side chain and n-pentyl alcohol.

14. The method for producing fullerene crystals according to claim 13, wherein the second solvent is at least one alcohol selected from the group consisting of i-propyl alcohol, i-butyl alcohol, 2-butyl alcohol, n-pentyl alcohol, and i-pentyl alcohol.

15. The method for producing fullerene crystals according to claim 11, wherein the concentration of the fullerene contained in the solution is at least 3 mg/ml as well as at least 0.3X (mg/ml), where X (mg/ml) denotes the solubility of the fullerene in the first solvent.

16. The method for producing fullerene crystals according to claim 1, wherein the benzene derivative (A) is at least one selected from a benzene derivative with a benzene ring that has been substituted at the para-position, and a benzene derivative with a benzene ring that has been substituted at 1,2,3-positions.

17. The method for producing fullerene crystals according to claim 16, wherein the benzene derivative (A) is at least one selected from the group consisting of p-xylene, 1,2,3-trimethylbenzene, p-dichlorobenzene, and 4-chlorotoluene.

18. The method for producing fullerene crystals according to claim 16, wherein the second solvent contains, in total, at least 50 wt.% of at least one selected from the group consisting of n-propyl alcohol, n-butyl alcohol, i-butyl alcohol, 2-butyl alcohol, n-pentyl alcohol, and i-pentyl alcohol.

19. The method for producing fullerene crystals according to claim 16, wherein the concentration of the fullerene contained in the solution is at least 3 mg/ml as well as at least 0.3X (mg/ml), where X (mg/ml) denotes the solubility of the fullerene in the first solvent.

20. The method for producing fullerene crystals according to claim 1, further comprising carrying out at least one treatment on the fullerene crystals obtained in the process (ii), the at least one treatment being selected from the group consisting of pressurizing, heating, and laser irradiation.

21. The method for producing fullerene crystals according to claim 1, wherein the fullerene includes an element other than carbon therein.

22. The method for producing fullerene crystals according to claim 1, wherein the fullerene is C60 or C70.

23. Flaky fullerene crystals obtained by a production method according to claim 11, the flaky fullerene crystals having a mean thickness in a range of 100 nm to 10 μm.

24. Particulate fullerene crystals obtained by a production method according to claim 16, the particulate fullerene crystals having a mean particle size in the range of 10 μm to 5000 μm.